Unit 6: Momentum and Force

Quiz → F 4/25

Test → T 4/29

Momentum:

- Momentum = (mass)(velocity)
  - increase or decrease either mass or velocity to change momentum
  - $\bar{p} = m\bar{v}$
  - units: mass → kg
    velocity → m/s
    momentum → kg·m/s
- Law of Conservation of Momentum
  - Total momentum of a system is conserved.

(system is all the objects you have)

- For this class, we have:
  - Collisions in 1-dimension
  - 1st object stops immediately upon impact and 2nd object starts immediately upon impact.
- Equation: $\bar{p}_i = \bar{p}_f$ (of system)

$$\bar{p}_{1i} + \cancel{\bar{p}_{2i}}^{\,0} = \cancel{\bar{p}_{1f}}^{\,0} + \bar{p}_{2f}$$

$$\bar{p}_{1i} = \bar{p}_{2f}$$

$$m_1 \bar{v}_{1i} = m_2 \bar{v}_{2f}$$

• Impulse - Momentum Theorem:

F → force
t → time
p → momentum

$$\bar{F}\,t = \bar{p}$$

$$\bar{F}\,t = m\bar{v}$$

$$\bar{F} = (m)\left(\frac{\bar{v}}{t}\right) = \frac{m\bar{v}}{t}$$

$$\bar{F} = m\bar{a} \qquad \bar{a} = \frac{\bar{v}}{t}$$

- Newton's laws:

1. Object in motion stays in motion or an object at rest stays at rest unless acted upon by an outside force. (unbalanced)

- Inertia → property of an object to resist change in motion or acceleration

2. Force = (mass)(acceleration)

$\sum \bar{F} = m\bar{a}$ $\sum$ → Greek uppercase sigma

$\bar{F}_1 + \bar{F}_2 + \bar{F}_3 + \ldots = m\bar{a}$ → sum of

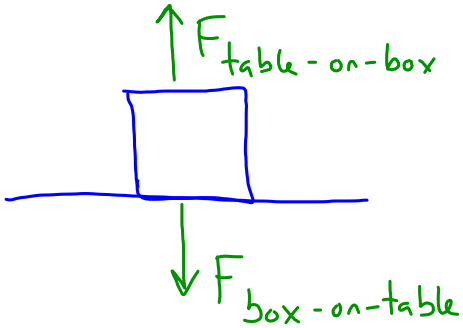
- Units: $m \rightarrow kg$

$a \rightarrow m/s^2$

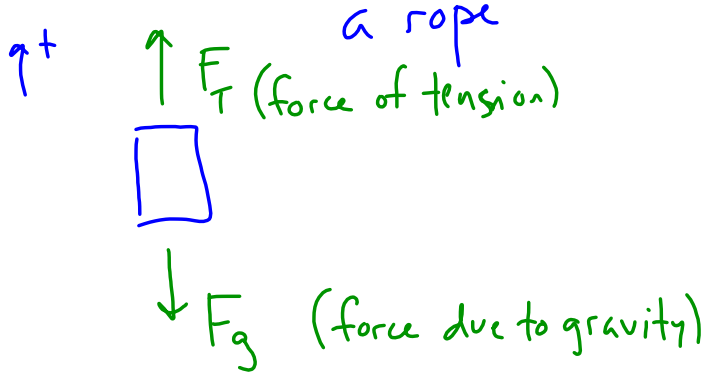
$F \rightarrow kg \cdot m/s^2 \rightarrow$ newton (N)

3. Forces come in pairs.

(For every action, there is an equal and opposite reaction.)



- Free-Body Diagram (FBD)
  - Way that we draw objects and forces to show what is happening
  - Example: Box being lifted by a rope



- To get acceleration, there are unbalanced forces.
  - Acceleration will be in the direction of larger force.
  - If forces are equal in magnitude and opposite in direction, object will not accelerate.

(Object moving at constant velocity or not moving at all.)